No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
9	Chemical-Specific Requirements	3.2.2	3-9		General	ARARs	It is inappropriate to use a simple example of applying an acceptable cumulative cancer risk level of 10^{-5} to polychlorinated biphenyls (PCBs). It is correct to state that 10^{-5} is the appropriate risk level for evaluating cumulative risk from all carcinogens. Regarding the evaluation of PCBs, the Oregon Department of Environmental Quality's (DEQ) approach is to apply the acceptable risk level of 10^{-6} for individual carcinogens to PCB congener data, if available. However, if congener data are not available, then DEQ applies the 10^{-6} acceptable risk level to total PCBs, with the assumption that all or most of the risk is due to one congener (see DEQ's 2010 Human Health Risk Assessment Guidance, Section 3.3.5). The Arkema Engineering Evaluation/Cost Analysis (EE/CA) should be revised to state that overall cumulative site risk must not exceed 10^{-5} rather than use the inappropriate PCB example.
10	Chemical-Specific Requirements	3.2.2	3-9		General	ARARs	It is incorrect to state that EPA's risk range of 10^{-4} to 10^{-6} is protective under the State of Oregon's cleanup rules. A 10^{-4} cumulative risk level that may be acceptable to EPA does not meet DEQ's acceptable cumulative risk level of 10^{-5}. In addition, DEQ's acceptable risk level of 10^{-6} for individual carcinogens would also not be met. DEQ's promulgated risk levels are applicable or relevant and appropriate requirements (ARARs) for the Portland Harbor Superfund Site. The Arkema EE/CA should be revised to address meeting this State ARAR.
11	Action-Specific Requirements	3.2.4	3-10		Specific	ARARs	The EE/CA should state that the reason for including mitigation under the Endangered Species Act (ESA) and/or the Clean Water Act in the evaluation of removal alternatives is to ensure that all appropriate costs associated with the removal action are accounted for.
12	AOPC 14-Specific Sediment Quality Guidelines for the Benthic Community	2.1.4	2-4		Specific	Benthic Risk Evaluation	The draft EE/CA states that benthic toxicity is the primary line of evidence (LOE) for evaluating benthic risk. The draft EE/CA should note the high degree of toxicity/bioassay hits offshore of the Arkema site. As documented in Maps 6-2 through 6-5 in the draft Portland Harbor baseline ecological risk assessment (BERA), sediment bioassays performed on samples collected offshore of Arkema showed high toxicity for all endpoints.
13	Technical Feasibility	8.2.1	8-7		Specific	Construction Sequencing and Durations	Regarding: "Under all of the alternatives, documentation sampling of excavated banks would be completed prior to cap placement; however, the bank capping could proceed before sample results were reported." Capping should not proceed until numeric bank standards have been achieved. These standards may be a depth (i.e., feet of material) or a chemical concentration. Documentation would be needed to ensure that the bank standard has been met prior to cap placement. The Arkema EE/CA should be revised to indicate that numeric bank standards will be achieved prior to capping.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
14					General	Cost Estimate	Although the Arkema site is currently being addressed under a non-time-critical removal action, LSS should follow the Portland Harbor process. Thus, EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, EPA 540-R-00-002 (EPA 2000) is relevant to development of cost estimates within the EE/CA. There are numerous deficiencies in the presentation and details of the estimated cost within the text of Section 7, Table 7-3 "Summary of Estimated Costs for the Arkema Early Action Removal Alternatives" and Appendix E "Cost Estimate Details." The cost estimates in the Arkema draft EE/CA should address all the key issues presented on page 1-1 of EPA's cost estimate guidance (EPA 2000). Specifically, the draft EE/CA did not clearly address the guidance or use terminology or assumptions for values consistent with the guidance, which made evaluation difficult. These issues include source references for quantity and unit cost information, basis for applied contingency, costs for professional and technical services, discussion of the time expected to achieve removal action objectives and goals (which affects maintenance and monitoring level of effort and cost), basis for period of present value analysis, major assumptions and sources of uncertainty in the overall estimate, analysis of sensitivity of cost estimate to uncertain factors, logical and organized presentation of cost estimate summaries and detailed backup information. The documentation of the estimates should follow the structure outlined in Chapter 6 of EPA's cost estimate guidance (EPA 2000), including detailed cost backup for each alternative (presumed Appendix E), individual cost summary sheets (not apparent if they were included in the draft EE/CA), and a comparative cost summary (presumed to be Table 7-3). The estimates should be updated to be consistent with the general presentation and assumptions indicated in EPA's cost estimate guidance (EPA 2000), especially with respect to transparency and documentation of assumptions and calculations such as quantity takeoffs, sources of cost information, and present value analyses (see **Comment #15**). Exhibit 5-13 on pages 5-18 and 5-19 of the EPA guidance can be used to review the revised cost estimate for completeness.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
15	Identification and Analysis of Removal Action Alternatives	7			General	Cost Estimate	Section 7 and Appendix E do not include a clear, consistent and detailed discussion of the present value analysis or how the frequency and nature of the operation and maintenance (O&M) work was derived for present value analysis. The cost discussion for each alternative appears to be overly brief and generic with apparently the same cost assumptions (including the same O&M duration and periodic expenditures) for each alternative. The information provided in Section 7 does not allow for assessment of the cost impacts from assumptions of O&M scope and corresponding durations to achieve removal action objectives and goals, and the varying durations of construction which impact capital cost outlays. It would be expected that the assumptions for present value analysis would differ due to the construction timing and scope of the construction and the resulting maintenance requirements of the alternative and thus the presentation of the resulting capital costs, annual O&M costs, and periodic cost outlays. For example, one would expect some alternatives to have high capital expenditures in the first few years of implementation and have variable O&M expenditures for the various follow-on activities. The present value costs for O&M of each alternative appear to differ which implicitly indicate differences in these assumptions for O&M, but assessing these differences is hampered due to the lack of transparency on how the present value analyses were developed such as timing of periodic costs such as cap repairs and monitoring events for differing alternatives to meet removal action objectives and goals. Since present value analyses do not include capital costs, it appears that the commonly used assumption of Year 0 for capital construction cost outlays was used. Clarification on this point should be provided. The alternative costs made the same generic assumption of a 30 year period of analysis for present value evaluation. Section 4.1 of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, EPA 540-R-00-002, (EPA 2000) indicates a blanket assumption of 30 years is not recommended, and that site specific justification should be provided for the period of analysis selected especially when the project duration exceeds the selected period of analysis (as is likely the case at the Arkema site). The statement that net present value costs after 30 years of analysis becomes diminishingly small, by itself, is not compelling site specific justification without a sensitivity analysis of the impacts of costs from that selected period. It is also suggested that the simplifying assumption of capital costs occurring in Year 0 also be reevaluated and rationale documented if the simplifying assumption is retained. Section 4.2 of EPA's cost estimate guidance (EPA 2000) indicates that the year 0 assumption can be modified if a preliminary project schedule is developed and it is known that capital construction costs will be expended beyond one year. Per Section 7 of the draft EE/CA, it is expected that there will be some variability in duration of capital construction. For example, according to the alternative descriptions, Alternatives 2i, 2r and 3i can be implemented in one construction season, while Alternatives 4i, 4r and 5 will take two to three construction seasons. Modifying the simplifying assumption for present value analysis based on this information may cause differences between alternatives in capital costs. However that should be determined after consideration of this comment, and the rationale for the assumption used should be documented. Please also provide additional detail of the expected expenditures within the cost estimate, and confirm that the alternative cost description of capital costs, annual O&M costs, any periodic costs, and present value analysis are clear and consistent with the cost estimate backup. Please detail the expected expenditures in the Section 7 cost discussions, such as "capital costs for the CDF are expected to be incurred in years ... and O&M costs are to occur every 5 years for ...." and so forth.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
16	Identification and Analysis of Removal Action Alternatives	7		Table 7-3	General	Cost Estimate	It appears that Table 7-3 "Summary of Estimated Costs for the Arkema Early Action Removal Alternatives" is a hybrid of the comparative cost summary and the individual cost summary required by Chapter 6 of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, EPA 540-R-00-002 (EPA 2000). Individual cost summary sheets were not presented for each alternative. According to EPA's cost estimate guidance (EPA 2000), the individual cost summary should present all capital costs, annual O&M costs, any periodic costs, and the present value analysis for the alternative. The draft EE/CA cost estimates do not present a transparent present value analysis (see **Comment #15**). Exhibit 6-2 on pages 6-5 and 6-6 of the EPA guidance (EPA 2000) presents an example of alternative cost summary sheets. The absence of supporting documentation for each alternative does not allow an independent review and/or verification of relative costs. According to the EPA guidance (EPA 2000), the comparative cost summary should present the total cost for each alternative, including total capital cost, annual O&M cost, total periodic cost, and total present value. The cost summary should also note any differences between alternatives for project duration or O&M costs for present value analysis. The guidance presents an example in Exhibit 6-3 on page 6-6. The estimate should be revised to comply with the EPA guidance document (EPA 2000).
17	Identification and Analysis of Removal Action Alternatives	7		Table 7-3	Specific	Cost Estimate	The line item entitled "Engineered Barrier Contingency" with an associated cost of $12,769,000 is not used or explained. Please clarify the use or remove this line item from the cost estimate.
18	Appendix E - Cost Estimate Details				General	Cost Estimate	Appendix E is entitled "Cost Estimate Details." Table E1 lists key assumptions and cites other past projects and other regional projects as cost basis. EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, EPA 540-R-00-002 (EPA 2000) states that the detailed cost backup should include a cost worksheet for each alternative with underlying assumptions, quantity calculation sheets and other supporting information. Additional supporting information can include cost calculation sheets, records of communication for vendor quotes, and conceptual design calculations. Sub-elements as they pertain to each alternative should be described in sufficient detail with assumptions clearly identified. If using past project experience as supporting information for cost data as presented in Table E1, the source should reference the cited project scope and location to determine whether the source is appropriate. For example, area cost factors and or escalation may need to be applied or differences in scope may need to be explained. Costs for labor, equipment and materials should be clearly separated and identified to the extent possible. The absence of supporting documentation does not allow an independent review and/or verification of relative costs. Thus Table E1 in its current form has insufficient documentation and transparency of assumptions to be used as detailed cost backup. To comply with the EPA guidance document (EPA 2000), please supply detailed data and underlying assumptions for cost backup to support the costs presented in the cost summary of each alternative.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
19	Dredge Material Disposal	6.6	6-17		General	Disposal Options	Section 6.6.1 states, "Existing sampling information indicates the excavated and dredged material would be suitable for placement in a Resource Conservation and Recovery Act (RCRA) Subtitle D solid waste landfill." Based on existing characterization data (including toxicity characteristic leaching procedure [TCLP] data) collected from the area of contaminated sediment proposed for dredging, it would be reasonable and prudent to assume that a portion of the excavated and dredged material generated for offsite disposal could contain characteristic hazardous waste and thus require management (including transportation; treatment, and/or disposal) as characteristic hazardous waste. Based on sampling results summarized in Section 2.3.3.1 on page 2-20 and 2-21, TCLP concentrations measured from three samples exceed the maximum concentration of contaminants for the toxicity characteristic presented in Table 1 of 40 CFR 261.24(b). This data indicates that dredged material in the vicinity of samples WB-37, WB-39 and WB-42, once generated, would exhibit the characteristic of toxicity for benzene, lead, and tetrachloroethylene with associated hazardous waste codes D018, D008 and D039, respectively. Figure 3-5 of the Removal Action Area Characterization Report (Integral and ARCADIS 2011) presents the sample locations of WB-37, WB-39 and WB-42. The depth and location of the samples are within the prism of proposed dredging and offsite disposal of Alternatives 2(i), 2(r), 3(i), 3(r), 4(i), and 4(r) presented in Figures 7-1 through 7-6 of the EE/CA. This indicates that there is a potential for several alternatives presented in the EE/CA to generate contaminated sediment containing characteristic hazardous waste for offsite disposal. However, the EE/CA makes an assumption that all excavated and dredged material would be suitable for placement in a RCRA Subtitle D solid waste landfill. The alternatives presented in the EE/CA that include offsite disposal of dredged sediment should assume that a portion of the sediment generated by dredging for offsite disposal could contain characteristic hazardous waste based on the three constituents discussed above, at a minimum. The potential generation of characteristic hazardous waste should be addressed and revised in the description of offsite disposal options in Section 6.6.1, with reasonable and defensible explanation for the assumptions presented. Also, the assumptions for management of the dredged sediment (including handling, transportation and disposal considerations) should be revised accordingly for each alternative assuming offsite disposal along with a re-evaluation of effectiveness, implementability, and cost due to this change in relevant sections of the EE/CA.
20	Offsite Disposal	6.6.1			General	Disposal Options	The EE/CA notes that dredged sediment and excavated riverbank soil can be managed at Subtitle D permitted solid waste landfill. Cost estimates in the EE/CA appear to be based on this assumption. If managed at an upland facility sediment and riverbank soil containing elevated levels of DDx are considered to contain a pesticide residue, and given the DDx concentrations measured, the material will likely have to be managed at a Subtitle C permitted facility as a State of Oregon Hazardous Waste (OAR 340-109-0010(4)). The cost implications of this waste characterization should be considered for the various alternatives in the EE/CA.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
21	Onsite Disposal	6.6.2				Disposal Options	It does not appear that LSS complied with expectations outlined within multiple letters from EPA for the EE/CA confined disposal facility (CDF) evaluation including a June 10, 2010 letter providing EPA's Response to Comments on the 2010 Preliminary Confined Disposal Facility (CDF) Screening Evaluation. The EE/CA frequently refers the reader to evaluations conducted in the draft Portland Harbor Feasibility Study (FS). However, the Arkema CDF information provided in both the EE/CA and draft Portland Harbor FS is insufficient to adequately address the protectiveness, implementability, or feasibility of a CDF at the Arkema site and therefore, EPA cannot recommend construction of a CDF at the Arkema site based on the available information. Specifically, there is insufficient information concerning floodway impacts, short-term contaminant transport, and habitat impacts. Appendix U of the draft Portland Harbor FS provides an evaluation of the CDFs against the EPA CDF Performance Standards. For many of the Performance Standards, the draft Portland Harbor FS indicates further evaluation will be conducted in the Arkema EE/CA. However, this further evaluation was not provided. Specifically: Section 9.3.9.1 of the draft Portland Harbor FS states that, "much of the details that are needed to meet the FS CDF Performance Standards or alternate standards that may be developed during remedial design will be addressed as part of the EE/CA, including a full ARARs analysis." However, this assessment could not be found within the draft Arkema EE/CA. Section 9.3.9.2 of the draft Portland Harbor FS discusses CDF containment berms relative to static and seismic stability. The draft FS refers back to the 2010 Preliminary Arkema CDF Screening Evaluation. No additional seismic evaluation was provided in either the Arkema EE/CA or the draft Portland Harbor FS as requested by EPA. Section 9.5.8.2 of the draft Portland Harbor FS discusses short-term impacts as a result of constructing the CDFs. Modeling was conducted for the Terminal 4 and Swan Island Lagoon CDFs to evaluate short-term water quality effects; however, the Arkema CDF was not included in this evaluation and the reader is referred back to the 2010 Preliminary CDF Screening Evaluation. Section 9.5.8.3 of the draft Portland Harbor FS discusses protection of fisheries and wildlife. The text indicates that the Arkema EE/CA will further address this performance standard. However, no additional information on this subject could be identified in the Arkema EE/CA. In addition, the conceptual design evaluated in the draft Portland Harbor FS is not the same design described in the Arkema EE/CA. The draft Portland Harbor FS indicates "the preliminary design concept for the Arkema CDF incorporates an upland barrier wall and circular cofferdams..." However, Section 7.2.8.4 of the Arkema EE/CA indicates the CDF would likely be constructed utilizing a sheetpile wall. The basis for changing from a two berth CDF alternative using a circular cell coffer dam per the 2010 Preliminary CDF Screening Evaluation to a sheet pile design should be described.
22	Introduction	1			General	Editorial	The EE/CA Early Action Work Plan (Parametrix 2007) and Work Plan addendum (2008) are the basic documents that were to control development of the EE/CA. LSS should discuss compliance with the Work Plan in the EE/CA (e.g., in Section 1) as was discussed in the Technical Briefing comments provided to LSS by EPA in March 2012 (Comment No. 21). In addition, LSS should reference the Technical Briefing and the comments provided in the Technical Briefing in the EE/CA.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
23	Introduction	1	1-1		Specific	Editorial	The Draft EE/CA states: "The analysis in this EE/CA report was developed to be consistent with the Portland Harbor FS approach and to ultimately support EPA's selection of an alternative and the preparation of design reports for the portion of the Portland Harbor site that includes SMA 14 and the Arkema RAA." The revised EE/CA should clarify the remedy selection process for the non-time critical removal action (NTCRA) at the Arkema site including the development of an action memo for selecting the removal action, public notice and comment, and the relationship of the removal action selection process with the Portland Harbor remedy selection process.
24	Remedial Measures Sequencing	1.5	1-10		Specific	Editorial	Item #2. This section states that the upland groundwater source control construction is scheduled to begin in the summer of 2012. This section should be updated to reflect the current status of the upland groundwater source control construction.
25	Distribution of PCDD/Fs	2.2.2.3		Figure 2-2	Specific	Editorial	The boundary presented in Figure 2-2 is based on a concentration of 36,000 picograms per gram (pg/g). This is more than 3 orders of magnitude higher than the current human health PRG of 20.5 pg/g and more than 20 times the RAL of 1,750 pg/g used in the draft EE/CA. The 36,000 pg/g contour is not discussed in the report and should be removed from Figure 2-2. (Note that some PRGs may change as a result of agreements reached between EPA and LWG.)
26	Description and Applicability	6.2.1	6-2		Specific	Editorial	Regarding: "Lastly, natural recovery processes will occur at the site." Natural recovery processes MAY occur at the site. Given the numerous factors that can affect natural recovery (variation in biodegradation rates, erosional events, etc.), it is incorrect to state that these processes WILL occur. For example, if monitored natural recovery (MNR) is selected for use at a particular location, and a short-term erosional event occurs, contaminated sediments may be exposed to flora and fauna, even though this area was "net depositional" over a period of time. In addition, the acute exposure of these "left-in-place" contaminants could prove toxic to exposed organisms for the period until the area is again covered by natural depositional processes. Finally, the primary consideration for MNR is whether MNR is protective of human health and the environment. Please revise the statement to say "Lastly, natural recovery processes may occur at the site, however, it is unclear whether MNR is sufficient to achieve protection of human health and the environment within a reasonable timeframe."
27	Bank Regrading and Capping	7.2.2.1	7-7		General	ESA Consultation and Mitigation	The EE/CA states: *Approximately 1,250 linear ft of riverbank would be regraded, including removal and offsite disposal of debris and localized riverbank highly contaminated material if identified. Cutting and filling soil along the riverbank would create a more uniform slope from the top of bank to the toe that is more stable and resistant to erosion. The slope of the regraded riverbank would be similar to the existing slope, which ranges from 1.5:1 to 2:1 (horizontal:vertical). Following regrading, a suitable soil cover would be placed. For the purposes of this EE/CA, it is assumed that this cover layer would be 3-ft thick; however, the final cover thickness would be determined during the remedial design.* The EE/CA needs revision to provide more information on the large mitigation requirements of this type of action. See also **Comment #11**.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
28	Appendix B - Biological Assessment				General	ESA Consultation and Mitigation	Appendix B presents a draft biological assessment. The National Oceanic and Atmospheric Administration (NOAA) has indicated that they will defer all biological consultations until the remedial design stage for each specific remedial action to be undertaken at the Portland Harbor Superfund Site (i.e., they will not be issuing a Biological Opinion for the Portland Harbor remedy as a whole) to ensure each action is protective of ESA-listed NOAA trust resources. As a result, Appendix B has not been reviewed by NOAA at this time. EPA may comment and seek revision to Appendix B for purposes of the ROD in the future.
29					General	Evaluation of Alternatives	Within the horizontal boundary of the Removal Action Area (RAA), any early action should be final. That is, residual contamination should not require additional remediation as part of the harbor-wide clean-up. This "one and done" philosophy requires that all contaminants of concern (COCs) and their appropriate preliminary remediation goals (PRGs) should be considered in the evaluation of protectiveness and long-term effectiveness, regardless of target risk. Depending on location, COCs other than DDx, particularly dioxins/furans, will be important considerations for risk reduction. The EE/CA should be revised to include all COIs in the work plan and Opalski Decisions in the evaluation of the vertical boundary of the RAA. The level and extent of this evaluation should be consistent with available data and concentrations of COIs relative to PRGs and should follow the evaluation process outlined in **Comment #52**. Moreover, a qualitative evaluation of all COCs identified in the FS for AOPC 14 should be included to demonstrate that the final vertical boundary is sufficient.
30	Identification and Analysis of Removal Action Alternatives	7		Table 7-2	General	Evaluation of Alternatives	Table 7-2 presents some human health PRGs and spatially weighted average concentrations (SWACs) for the various remedial alternatives. It is not clear at what time or what area the SWACs were calculated for. For example, do the alternatives achieve the PRGs/Remedial Goals (RGs) at T=0 (i.e., immediately following construction completion) or at some future year after MNR? For all alternatives the EE/CA should clearly identify the time period at which the SWAC estimates were calculated (e.g., T=0 after active remedial actions or T=30 after MNR). The goal should be that SWACs over an appropriate exposure area achieve PRGs/RGs (or background) at T=0 or as close as possible to T=0. In other words, active remediation should be relied upon for the majority of cleanup and MNR used to finish the job. It is not clear to what extent the EE/CA alternatives rely on MNR to achieve PRGs/RGs.
31	Identification and Analysis of Removal Action Alternatives	7			General	Evaluation of Alternatives	Habitat Mitigation - Remedial Alternatives 2i through 4r do not include habitat mitigation costs. Alternative 5 includes $150,000 for habitat mitigation. Please provide the basis for concluding that mitigation is not required for Alternatives 2i through 4r and the basis for the costs associated with Alternative 5 (CDF). Based on EPA's review of the draft EE/CA, alternatives that include dredging and capping (Alternatives 2i through 4r) would likely require mitigation. There is no discussion that leads the reader to believe LSS has any appreciation of the order of magnitude of mitigation costs associated with a CDF. The fact that this mitigation project would be in the millions of dollars needs to be reflected in the cost estimates and text. Further, while LSS references the use of the draft Portland Harbor FS mitigation estimate in Section 3.2.4 (page 3-10), it does not appear that LSS used the Portland Harbor FS mitigation process to actually prepare the cost estimate shown on Table 7-3 given the lack of mitigation costs and the low value provided for Alternative 5. EPA's Technical Briefing Comment No. 13 (comment letter dated March 28, 2012) requested that mitigation costs be consistent with the Portland Harbor FS process and as modified by EPA's July 15, 2011 comment letter to LWG that provided additional clarification on developing mitigation costs. The mitigation cost estimates in the EE/CA should be revised to follow the same process as used in the draft Portland Harbor FS and as modified by EPA's July 15, 2011 comment letter.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
32	Identification and Analysis of Removal Action Alternatives	7			General	Evaluation of Alternatives	The Oregon Division of State Lands (DSL) is the owner of the submerged lands offshore of the Arkema site. DSL ownership should be depicted on site figures and any DSL coordination issues/impacts for various alternatives should be explained (e.g., if DSL needs to concur on CDF construction).
33	Bank Regrading and Capping	7.2.2.1			General	Evaluation of Alternatives	The cost estimate presented in Attachment 1 of Appendix F does not appear to meet the minimum requirements of EPA's *A Guide to Developing and Documenting Cost Estimates during the Feasibility Study*, EPA 540-R-00-002 (EPA 2000). Please refer to **Comments #14** through **18** for additional direction regarding general cost estimate guidance.
34	Evaluation of Alternative 2(i)	7.2.2.11	7-12		General	Evaluation of Alternatives	The EE/CA states: "*By meeting the RALs in surface sediments, Alternative 2(i) would be protective of human health and the environment.*" Alternative 2(i) fails to appreciate the substantial monitoring requirements that would be involved as does 2(r). More detail regarding monitoring requirements and associated costs are needed in the EE/CA for all alternatives.
35	7.2.2.11 Evaluation of Alternative 2(i)	7.2.2.11	7-11		General	Evaluation of Alternatives	Starting with Alternative 2(i), reduction in sediment concentrations remain constant for DDx and 2,3,4,7,8-PCDF. Remaining alternatives expand the footprint without addressing a large mass of contamination being left in place at depth. This issue is not mentioned in the report, and is not evaluated in any way in the EE/CA. The EE/CA needs to be up front about the mass and concentrations being left in place in all alternatives, and should discuss the long-term effectiveness (i.e., possibility of release) and permanence. At least one alternative should consider removal of the bulk of the mass and reduce concentrations using the 5 milligrams per kilogram (mg/kg) vertical boundary, and other boundaries using a risk-based target in accordance with the 2011 Opalski Decision. The 2011 Opalski Decision states: "LSS is to follow the direction provided by EPA to incorporate at least the PRGs available from the harbor-wide RI/FS process, and SLVs for COIs where PRGs are not available, in evaluating the impacts of dredging and/or taking other removal actions to a range of concentrations vertically. Consistent with my prior dispute decision, LSS shall also include an evaluation of implications of dredging to the extent of 5 ppm DDx vertically. LSS also may evaluate implications of active removal to other concentrations, including concentrations that may be derived primarily from a mass to volume relationship."
36	Construction Approach	7.2.2.6	7-9		Specific	Evaluation of Alternatives	The EE/CA states: *"Existing Outfalls 1 through 4 would be protected prior to placement of the cap."* The EE/CA should indicate whether the outfalls will be abandoned as part of the source control measures being undertaken at the site. If appropriate, the implementability of abandoning one or more outfalls should be evaluated in the EE/CA (e.g., to remove targeted dredge material). In addition, the above statement is not true, especially considering prop scour, flood scour, etc.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
37	Comparative Analysis of Removal Action Alternatives	8			General	Evaluation of Alternatives	The comparative analysis of alternatives concludes that Alternatives 2-5 are protective and meet sediment removal action objectives (RAOs) and that the only balancing factor that differentiates between alternatives is short-term effectiveness (i.e., the more you dredge the greater the detrimental impact to the environment). This is largely based on: LSS' position that rigid containment during dredging is ineffective and potentially harmful (national examples of problematic applications are discussed in detail, but not the successful local application within Portland Harbor with similar contaminants at Arco); the Portland Harbor FS fate and transport (F&T) model that predicts natural burial; that waiting years for MNR to achieve RAOs/RGs is acceptable; and that the upland hydraulic control provides an adequate long-term remedy for contaminated subsurface river sediment. Making different assumptions and providing a more graduated range of alternatives would likely lead to different conclusions. In other words, it appears that the EE/CA is weighted to favor minimal remedial action, and it therefore is less objective than it should be. The Arkema EE/CA should be revised to address these various issues as discussed in **Comments #39**, **#43**, **#44**, **#46**, **#66**, **#75**, **#106**, **#107**, **#108**, and **#111**.
38	Achievement of RAOs	8.1.2			General	Evaluation of Alternatives	The document states that each alternative would create a post-construction surface that meets remedial action levels (RALs). RALs are not PRGs, but a means to delineate sediment that requires active remediation. The EE/CA must demonstrate, and should be revised to indicate, that by cleaning up to a RAL, the PRG (or RG) will be achieved over the appropriate exposure area. It is not clear how long it will take for MNR areas to achieve PRGs or RGs. The revised EE/CA should include this estimate to support the determination that alternatives that rely on MNR are protective.
39	Long-term Effectiveness and Permanence	8.1.4	8-3		General	Evaluation of Alternatives	Regarding: "MNR would be applied within a maintenance and monitoring framework developed during the remedial design, which would establish protocols to monitor natural recovery and to implement, as necessary, additional remediation measures (e.g., ENR, capping) should monitoring indicate that natural recovery is not achieving the removal action objectives." The effectiveness of MNR as a remedial method has not been established for the Arkema site. A more thorough assessment of whether MNR would be appropriate should be prepared, otherwise MNR should be screened out as a major component of the remedial alternatives due to the high contaminant concentrations, lack of sediment deposition and fine-grained sediments in this reach of the river, and the lack of a definitive empirical trend documenting a decline in DDx sediment levels.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
40	Recommended Removal Action Alternative and Implementation	9			General	Evaluation of Alternatives	Evaluation of Removal Alternatives: The draft EE/CA recommends Alternative 2i. This alternative over estimates the effectiveness of MNR within the RAA. The Administrative Order on Consent (AOC) and Statement of Work (SOW) for the removal action at the Arkema site does not suggest a preference for removal-based remedies. However, material present within the horizontal boundary of the Arkema RAA may be classified as a Principal Threat Waste (PTW) under EPA guidance or Hot Spots of contamination under Oregon cleanup law due to the presence of source material (non-aqueous phase liquid [NAPL]) at the site. [EPA's December 18, 2012 letter to LWG transmitting comments on the draft Portland Harbor FS indicated that EPA does not agree with LWG's PTW and Hot Spot analysis, and highlighted the Gasco and Arkema sites as containing at least PTW due to the presence of NAPL in sediments.] As a result, there is an expectation of treatment to reduce the toxicity, mobility and volume of the material and a higher cost threshold for removal or treatment of PTW and Hot Spots of material. In consideration of these points, a removal action alternative that includes effective source control (river bank, groundwater and stormwater), removal, and placement of an engineered cap that includes a reactive treatment layer should be able to reduce risks within the RAA in a cost effective manner that ensures long term protectiveness if properly monitored.
41	Appendix F - Riverbank Alternatives Evaluation		4		General	Evaluation of Alternatives	Baseline Habitat Condition Survey, second paragraph: While LSS completed the evaluation necessary to determine if mitigation would potentially be required for the various riverbank alternatives, they concluded "due to the uncertainty of habitat ranking values applicable to Portland Harbor, no specific habitat value comparison was developed for this RAA Riverbank alternatives evaluation". Consequently, the riverbank element of the EE/CA does not account for the potential significant costs associated with habitat mitigation and the potential relative differences between the bank alternatives. NMFS has indicated LSS could use the habitat values NMFS developed for ESA consultation in Portland Harbor to get a general idea of the habitat ranking values and determine approximate costs of mitigation. Section 4.2.3 of the main text of the EE/CA should be revised to reflect appropriate general habitat rankings for the Arkema site. The cost estimates should be revised to take into consideration the costs associated with habitat mitigation.
42	Appendix F - Riverbank Alternatives Evaluation		7		General	Evaluation of Alternatives	Compatibility with In-Water Removal Action: Although DEQ made it clear that groundwater or stormwater source control measures (SCM) must not limit riverbank or sediment remedies, the EE/CA argues against riverbank alternatives with shallower slopes because they may interfere with the groundwater SCM (i.e., groundwater barrier wall). The EE/CA evaluated and rejected riverbank alternatives with 5:1 slopes based on an evaluation of implementability that considered the groundwater SCM. However, a slope angle in between the 5:1 slope and a 2:1 slope should be considered that would not threaten the groundwater barrier wall. In addition, riverbank alternatives should also consider offshore filling activities such that the necessary slope angle is maintained. The recommended riverbank alternative removes limited contaminated soil and retains the current steep slopes (1.5:1 to 2:1), which will not likely provide any improvement in habitat. Section 4.2.3 of the main text of the EE/CA may need to be revised based on the response to this comment.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
43					General	Fate and Transport Model/MNR	Effectiveness of MNR: A subset of the removal alternatives evaluated in the draft EE/CA rely on MNR to address the downstream portion of the RAA. The evaluation relies on many of the same lines of evidence that were utilized in the draft Portland Harbor FS. However, the draft EE/CA misrepresents many of the lines of evidence: • Surface to subsurface sediment ratios: While it is true that the subsurface sediment levels are significantly higher than surface sediment concentrations, surface sediment concentrations are still elevated – range from approximately 1 mg/kg to 30 mg/kg total DDx. In addition, the evaluation fails to acknowledge subsurface DNAPL transport as a contaminant migration pathway which could account for the higher levels of contamination present in subsurface sediment. Finally, the analysis fails to account for the length of time since the release occurred (approximately 50 years). The continued presence of elevated levels of DDx in surface sediments suggests that MNR is not likely to be effective. • Evaluation of bathymetric change: The bathymetric change maps presented in the draft Portland Harbor FS do not encompass the nearshore areas in the vicinity of the dock structures because the bathymetric surveys did not cover these areas. In addition, while the bathymetric change maps show that areas offshore of the RAA tend to be depositional, areas downstream of the RAA appear to be a mixed case with areas of small scale erosion and deposition. Figure 3.1-12 in the Portland Harbor Remedial Investigation (RI) Report demonstrates the area between and downstream of the two docks is deepening while the area offshore of the docks in the navigation channel is depositional. • Grain Size: Area of Potential Concern (AOPC) 14 is approximately 50% fines. In contrast, the AOPC 16 immediately upstream is greater than 80% fines. The area offshore of the Arkema site is approximately 40% fines while Figure 3.1-12 in the Portland Harbor RI Report demonstrates that the RAA is in the 20 – 40% fines range. These ranges are not indicative of highly depositional areas. The sections in the Arkema EE/CA that discuss the topics identified above (i.e., surface to subsurface sediment ratios, potential subsurface DNAPL transport migration pathway, evaluation of bathymetric change, and evaluation of grain size) should be revised to address the identified issues.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
44	In-waterway Sediment Transport and Deposition and Surface Sediment Grain Size/Bathymetric Survey Data	4.2.5 and 6.2.2.2 and 6.2.2.3	4-3 and 6-3 through 6-4		Specific	Fate and Transport Model/MNR	The lines of evidence presented in these sections (grain size and bathymetry) suggest that the area offshore of Arkema may be amenable to natural recovery. However, this statement contradicts data presented in Portland Harbor RI Report. For example, Portland Harbor RI Report Map 3.1-2 shows that while sediments offshore of the Arkema site are fine grained, these are confined primarily to the navigation channel. A map should be provided in the EE/CA of the actual grain size results in the surface samples in order to evaluate findings. Similarly, while the bathymetric change maps show that sediments are accumulating offshore of the Arkema site, much of the nearshore area was not covered by the various bathymetric surveys or show a mix of deposition and erosion. Map 3.1-7 in the draft Portland Harbor FS shows the measured change in bathymetric elevations between July 2002 and January 2009. While most of Area 1 is in an area that accumulated sediment between July 2002 and January 2009, Area 2 appears to be in an area that lost sediment during this time period (i.e., erosional). Additionally, figures in Chapter 6 of the draft Portland Harbor FS show that the sedimentation rates along the west shore at River Mile (RM) 6.5 are highly variable (e.g., Figure 6.2-2). Finally, the presence of elevated levels of sediment contamination off shore of the Arkema site despite the relatively low levels of DDT and related chemicals in incoming sediments suggests that MNR is not effective at reducing contaminant levels offshore of the Arkema site either due to continual reworking of the sediment or the presence of ongoing sources (e.g., bank erosion and site runoff) that continue to recontaminate the sediment bed. Arkema EE/CA Sections 4.2.5, 6.2.2.2, and 6.2.2.3 should be revised to address the data identified above.
45	Sediment Surface and Subsurface Contaminant Concentrations	6.2.2.1	6-3		Specific	Fate and Transport Model/MNR	The draft EE/CA states that the presence of higher levels of contamination in subsurface sediments (2 – 10 feet below mudline) is due to the deposition of clean sediments. However, the draft EE/CA does not discuss the potential for the contamination being the result of dense non-aqueous phase liquid (DNAPL) migration from the former waste product pond to the Willamette River. In addition, the evaluation does not discuss the fact that significant levels of DDT and related chemicals are present in surface sediments offshore of the Arkema site. The EE/CA text should be revised to discuss both of these concepts.
46	Evaluation of Alternative 2(i)	7.2.2.11	7-11		Specific	Fate and Transport Model/MNR	Alternative 2i: Surface sediment downstream of the dock area have elevated levels of total DDx (in the 1 mg/kg range), are generally less than 40% fines and show a mix of erosion and deposition. As a result, MNR seems unlikely to achieve RAOs in downstream areas and thus should be eliminated as a remedial technology for contaminated sediments at the Arkema site.
47	Recommended Removal Action Alternative and Implementation	9	9-1		Specific	Fate and Transport Model/MNR	The recommended alternative, Alternative 2(i), is not expected to be effective due to the reliance on MNR to address areas of sediment contamination downstream of the dock areas. Rather, alternatives that rely on a combination of capping, removal (greater than the amount necessary to place the cap), and effective source control represent a more balanced approach that may achieve protectiveness consistent with the National Contingency Plan (NCP). The alternatives should be revised to remove the reliance on MNR.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
48					General	Integration with Portland Harbor Process	Compatibility with Long-Term Cleanup Actions: The draft EE/CA fails to consider the compatibility of the removal action with long term remedial actions at the Portland Harbor site outside the RAA. EPA acknowledges that the RAA has been established based on a 5 mg/kg total DDx concentration. However, the removal action will need to be implemented in such a way as to not limit future actions outside the RAA. The EE/CA should elaborate in more detail how each alternative will synchronize with the likely FS remedy on the periphery of the RAA. Information regarding the sequencing relationship between the EE/CA and harbor-wide cleanup should also be discussed.
49	Appendix A - Sediment Data Screening				General	NRDA	Appendix A2 includes a discussion of injury thresholds (the site-specific SQGs) and service losses. This discussion is specific to the Natural Resource Damage Assessment (NRDA) and should be removed from the EE/CA.
50	Appendix F - Riverbank Alternatives Evaluation		6		General	Oregon Hot Spots and PTM	Consideration of Hot Spots: DEQ agreed that the riverbank hot spot evaluation did not have to evaluate highly mobile hot spots that are mobile because of erosion. All other elements of the hot spot evaluation for the riverbank are required. Further, DEQ agreed to defer (or not require) the identification of highly mobile erosion-related hot spots pending a review of the adequacy of the riverbank alternatives. The EE/CA should be revised to include the riverbank hot spot evaluation.
51	Removal Action Area Characterization	2			General	RAOs, RGs and RALs	The PRGs and RGs provided as part of the harbor-wide process are currently being revised based on recent discussions between EPA and LWG. This change will have a significant effect on the harbor-wide FS as well as the Arkema EE/CA. Once the revisions are completed, the revised EE/CA will need to incorporate any revised PRGs and RGs rather than the current focused PRGs.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
52a	Removal Action Area Characterization	2		**5-step process comment**	General	RAOs, RGs and RALs	Section 2 should be revised to follow the flow of logic below. The current presentation is confusing, suffused with inappropriate and irrelevant site-wide and AOPC-14 specific information, and fails to set forth readily identifiable logic sufficient to allow EPA to select a sediment removal action at the Arkema site. Further, the current introduction suggests that Section 2 is basically a summary of available information. In fact, considerable and critical analysis is included in the section. Revision and reorganization of Section 2 should include the following steps. This outline should then be used in the subsequent evaluation of removal action options. Note that this outline is intended to be consistent with and complement the process used in the Portland Harbor FS. The main objective is to note where Arkema-specific issues arise and how the EE/CA should approach addressing these issues. (1) The section should begin with a clear statement of its objectives, including identification of the area of interest (west bank, RM 6.5 to 7.5); description of data available for use in alternatives development; summary of data that will be used for description of contaminant distributions (nature and extent); identification/developmentof appropriate PRGs, RGs, SWACs and RALs, with the latter two needs being specific for the RAA as defined in the Opalski Decision; identification of key geotechnical properties of sediments and issues these properties may present for alternatives analysis; description of surface debris and its affect on alternatives analysis; and summary and conclusions. PRGs and RGs used in the harbor-wide FS are being revised and these revised PRGs and RGs should be used in the Arkema EE/CA. Recall also that the Opalski Decision calls for use of these PRGs/RGs as well as, at a minimum, SLVs and estimates for background. The EE/CA should discuss available PRGs and RGs, determine if any additional criteria are needed to complete the EE/CA and justify the choice of these criteria, as necessary. The report should be specific in identifying all sources of data used to describe contaminant nature and extent (e.g., LWG database, EE/CA characterization efforts, others). All SWAC and RAL calculations should use only data from the west bank between river miles 6.5 to 7.5. SWAC and RAL calculations should be consistent with similar calculations in the harbor-wide FS, but should also consider vertical extent to the base of the RAA. The FS used data only from the top 30 cm for SWAC and RAL estimates. A very worthwhile addition to the report would be cumulative distribution plots of data (e.g., box and whisker plots) with appropriate PRGs and targets (PRGs, RGs, SLVs, background and/or RALs) highlighted. Such plots could supplement subsequent figures that show the spatial distribution of contaminants with reference to these criteria. Finally, the report should evaluate site-specific background as if it were a possible target for defining the RAA. This approach is consistent with the Opalski Decision and will provide an illustration of the maximum vertical extent of the RAA that could be considered for remediation. **(Comment continued below)**

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
52b	Removal Action Area Characterization	2		**5-step process comment**	General	RAOs, RGs and RALs	**(Continued from Comment #52a)** As an example, in the draft FS, the EPA-directed RALs for 2,3,4,7,8-PCDF were 0.02 ppb (Alternative E), 0.01 ppb (Alternative F), and 0.005 ppb (Alternative G). These values are higher than many of the PRGs listed in Appendix Fa. The tables in Appendix Fa also show that the application of these RALs is insufficient to achieve all of the PRGs. These tables also indicate that a RAL of 0.02 ppb (Alternative E) would address some of the risk values, but would still result in a site-wide SWAC of 0.000824 ppb, which exceeds two of the site-wide PRGs. The SWAC for RM 6.5 to 7.5 under this alternative would be 0.00283 ppb, which would exceed three of the PRGs applied on a 1-river mile basis. A RAL of 0.01 ppb (Alternative F) would result in a SWAC of 0.000728 ppb, which would exceed one of the site-wide PRGs. The SWAC for RM 6.5 to 7.5 under this alternative would be 0.00227 ppb, which would also exceed three of the PRGs applied on a river mile basis. Because Alternative G was not evaluated in the FS, SWACs were not calculated for this alternative. *Arkema-specific RALs* should be used in similar comparisons to demonstrate how proposed actions within the RAA address human health and ecological risks. (Note again, that PRGs and RGs are in the process of revision.) (2) The section should then include a clear discussion of PRGs (and other targets as appropriate) for all contaminants of interest (COIs) included in the Opalski Decision. This process should include identification of the universe of PRGs and other targets for all COIs. Subsequently, the section should clearly describe refinement of this list to PRGs and other targets most useful to alternatives analysis. This identification and assessment of PRGs must include PRGs and other targets based on non-cancer effects as well as cancer risk, and estimates for harbor-specific background concentrations. The analysis should consult the harbor-wide process for any changes in PRGs, since neither the human health nor ecological baseline risk assessments have been finalized. The analysis should also follow the lead of the harbor-wide process for use of the new reference dose (RfD) for TCDD (dioxin) equivalents recently placed on the Integrated Risk Information System (IRIS). The harbor-wide process should be consulted for any other changes involving toxicity criteria. (3) The section should present an analysis of nature and extent of all COIs within the RAA (5 mg/kg DDx horizontal isoconcentration boundary). This analysis will look similar to the analysis in the current document, but should include only numerical/graphical depictions of data distributions. That is, this section should not try to interpret distributions yet in terms of defining the vertical extent of the RAA. It is recommended that empirical data should be overlain on the EVS model output to show how empirical data and model results coincide. Such figures should be developed for at least DDx and dioxin/furan toxic equivalents (TEQ). Data processing as described in the Baseline Human Health Risk Assessment (BHHRA) should be used when calculating DDx, dioxin/furan TEQ, total chlordanes and PCB congeners. Note that use of RALs calculated for the draft Portland Harbor FS is inappropriate here and elsewhere in the document. RALs should be calculated and used later in the report using data from only the area of interest. This area starts just above identified release points along the Arkema shoreline, at approximately RM 7.5 and continues down the west bank from the ordinary high water (OHW) mark to the edge of the navigation channel. Moreover, the analysis will consider depth to bed rock within the RM 6.5 to 7.5 west bank reach in identifying the appropriate database. Further refinement of this database for use in the EE/CA should then be described and justified. No data from the navigation channel or the east bank should be used for any purpose in the EE/CA. **(Comment continued below)**

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
52c	Removal Action Area Characterization	2		**5-step process comment**	General	RAOs, RGs and RALs	**(Continued from Comment #52b)** (4) Based on the results of comparisons of data for COIs to PRGs and other targets as appropriate in Step 3 above, the next step is to decide which PRGs and/or targets for which COIs should be refined into RGs, and for which SWACs and possibly RALs are needed. EPA expects that RGs will be available from the FS for COI used in defining the RAA, and that separate RGs for Arkema will not need to be developed independently. This section should use the data set described above to calculate SWACs for each of PRG/COI pairs. That is, if PCBs are identified as important based on PRG exceedances, SWACs will be needed to determine if concentrations are sufficient to suggest the need to calculate RALs. Resulting RALs specific to the RAA and west bank immediately downstream will then form the basis for the very useful figures that show the spatial distribution of exceedances of RALs. RAL calculations can be developed here (Section 2) or in Section3. Figures showing spatial distribution versus RAL (Section 3, currently) provide one critical means to visualize the horizontal area that may be considered for removal, capping, etc., and allow easier evaluation of the importance, or lack thereof, of all COIs in evaluating alternatives. (5) Conclusions of Section 2 should include the following issues/considerations-- RALs (health and ecological based), specific for the RAA, that are critical for evaluating risk reduction; needs for post-action monitoring and recontamination; overlapping patterns of COI distributions and how they may affect RAA vertical definition; data gaps and uncertainties in available data and calculations using those data (e.g., the considerable number of PCB analyses that report no detection, but with high detection limits). In all cases, the discussion should consult the FS process. For example, needs for post EE/CA monitoring should be consistent with and perhaps integrated into harbor-wide monitoring. As appropriate, some of this discussion may be limited to describing the process that will be used to make the EE/CA consistent with the harbor-wide FS. Following the above outline in Section 2 and continuing the process through subsequent sections, will address many comments submitted by stakeholders, including: a) LSS concludes that almost all RAL exceedances are at depth in Area 2. This conclusion is based on a single set of RALs that are unreasonably high and inconsistent with the alternatives for the harbor-wide FS. The RALs from Table 7.1-1 of the draft Portland Harbor FS should all be evaluated in the draft Arkema EE/CA. b) Monitored natural recovery will be an important determinant of residual risk over the long-term. Examining all COIs in some detail will be key both to justifying the choice of drivers for defining the vertical extent of the RAA, and for developing an effective monitoring plan to assess effectiveness of the removal action. **(Comment continued below)**

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
52d	Removal Action Area Characterization	2		**5-step process comment**	General	RAOs, RGs and RALs	**(Continued from Comment #52c)** c) Although the EE/CA was intended to be consistent with the draft Portland Harbor FS, the alternatives presented are not, and neither is the evaluation of those alternatives. In particular, the EE/CA uses three RALs: 400 parts per billion (ppb) DDE, 6,000 ppb DDT, and 1.75 ppb 2,3,4,7,8-PCDF (polychlorinated dibenzofuran). These RALs are applied in all alternatives and appear to be based on an inappropriate application of risk management principles. In contrast, the draft Portland Harbor FS applies RALs for three additional contaminants (PCBs, benzo(a)pyrene, and DDD), as well as levels ranging from 10 to 1,000 ppb DDE, 20 to 150 ppb DDT, and 0.005 to 0.02 ppb 2,3,4,7,8-PCDF. The EE/CA must consider the range of RALs considered in the draft FS. The EE/CA should fully evaluate which PRGs must be utilized in the EE/CA such that protectiveness can be properly evaluated. d) The Opalski Decision recognizes that harbor-wide considerations, including "at least" PRGs, should be considered in the Arkema EE/CA, but never mentions "focused PRGs". The intent of the EE/CA should be consistency with the harbor-wide FS. The EE/CA has a number of PRGs to consider, separately and perhaps in combination, to evaluate alternatives. e) EPA notes that it may be necessary to develop RGs specific to the Arkema early action. For example, it is difficult to fathom that an RG for smallmouth bass consumption would not be developed for DDx for the Arkema site. If this is the case, close coordination with the harbor-wide process will be necessary. f) Hexachlorobenzene concentrations show unacceptable risk in fish from the area offshore of the Arkema site, so RALs should be developed for the chemical. g) Apparently, RALs for AOPC-14 are used to define appropriate RALs for the RAA. These areas (horizontal and vertical) are dissimilar, and RALs need to be calculated specifically for the areas of concern. That is, RALs are location specific and it makes little sense to consider RALs for anything other than the area of interest (i.e., the RAA and the west bank immediately downstream). Moreover, the text addresses constituents of DDx independently. While PRGs based on individual constituents may be useful in the evaluation, the bottom line for evaluation of risk reduction, recontamination and time trends must be based on DDx. EPA notes, in this regard, that Section 2 never mentions the conversion of DDT to DDE and its impact on tissue DDE concentrations in smallmouth bass, or other species. Finally, the text again inappropriately makes reference to risk management decisions for the harbor-wide process. These considerations are irrelevant to the EE/CA and should be removed. h) RALs for RM 7 to 8, at least half of which is upstream of the Arkema site, are not relevant for screening or any other use. Also, screening total DDx against only a single PRG based on ecological receptors is unacceptable. EPA reiterates its stance that the EE/CA analysis should be consistent with the harbor-wide process, but cannot rotely apply all decisions presented in the draft Portland Harbor FS. A great deal of information is available in the Portland Harbor RI Report and risk assessments, and Arkema documents and database that will be useful for the EE/CA, but less so for the harbor-wide process. All of these comments must be kept in mind to appropriately revise Section 2 and subsequent sections of the EE/CA.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
53	Overview of Portland Harbor PRGs/RGs/RALs and AOPC 14 SQGs	2.1			General	RAOs, RGs and RALs	The Arkema EE/CA does not use the full range of PRGs presented in the draft Portland Harbor FS. While many of the PRGs are presented in Table 2-1 of the draft EE/CA, only a subset of the PRGs are utilized. PRGs used in the Portland Harbor FS were selected to represent a range of concentrations, exposure pathways and receptors to facilitate risk management decision making at the Portland Harbor site. The fact that some PRGs are based on a 10^{-6} risk level while others are based on a 10^{-4} risk level should not be grounds for rejecting this approach. In the context of the Arkema EE/CA, these PRGs are to be used to ensure that no unacceptable contamination is left behind at depth within the final RAA footprint that might have to be later addressed in the harbor-wide process. Note that this comment and the discussion that continues below may no longer be appropriate when revised PRGs and RGs are finalized by EPA for the harbor-wide process. The comment is included as a response to the text presented in the draft EE/CA. In general, the PRGs selected for use in the Portland Harbor FS were based on 10^{-6} risk level unless that risk level resulted in concentrations less than background. As a result, a 10^{-6} risk level may be achievable for DDT and related chemicals but 10^{-6} risk levels for other chemicals may not be achievable due to background conditions within the Willamette River watershed. EPA intends to base Portland Harbor RGs on 10^{-6} risk levels, their point-of-departure for cancer risks, as well as hazard index of 1. This will remove the inconsistency of using different acceptable risk levels for carcinogens. EPA recognizes that risk-based cleanup levels will be below regional background contamination levels of PCBs. EPA's intent in presenting the initial PRG based on a low fish ingestion rate and 10^{-4} risk level was to show what would be accomplished by remediating to regional background levels. In addition, the contaminants to be addressed by the non-time critical removal action (NTCRA) at the Arkema site are generally collocated with one another. As a result, it is useful to understand the degree of risk reduction that may be achieved for each contaminant and the degree to which background conditions preclude achieving risk based criteria. The text suggests that it would be inappropriate to use a PRG based on a target risk of 1×10^{-5} for chemical B once a cleanup target reaches 1×10^{-4} for chemical A, arguing that the reduction in risk would be minimal. This simplistic conclusion ignores the likely consequences of a more aggressive cleanup, which would not only affect chemical B, but would also further reduce risk due to chemical A. The result may be reduction in risk much greater than the 10% implied in the document. In addition, using a risk target of 1×10^{-4} ignores the State of Oregon ARAR discussed in **Comment #10**. The EE/CA should be revised to address overall risk reduction associated with a range of PRGs for COIs identified for the Arkema EE/CA. The text concerning use of 10^{-4} will be removed and risk reduction estimates for all alternatives revised to address cumulative impacts of residual COC.
54	Portland Harbor PRGs	2.1.1			General	RAOs, RGs and RALs	Reference Dose for TCDD (dioxin) equivalents: EPA has recently published a RfD for TCDD equivalents. This RfD implies a relatively low PRG – in the range of those based on cancer risk. Use of a PRG estimated on the basis of hazard indices (HIs) of 1 and 3 may need to be factored into the analysis depending on how EPA directs its use harbor-wide. EPA will provide further direction on whether a PRG based on the TCDD RfD will have to be calculated.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
55	Portland Harbor PRGs	2.1.1	NA	Table 2-1	Specific	RAOs, RGs and RALs	Table 2-1 should be revised to include all applicable background PRGs, if available (e.g., total PCBs of 17.7 micrograms per kilogram [µg/kg]).
56	Portland Harbor PRGs	2.1.1	2-2		Specific	RAOs, RGs and RALs	The draft EE/CA states: "EPA has not provided the rationale for their selection of the focused PRGs..." This is inaccurate. Rationale for PRGs was provided in EPA's April 21, 2010 letter and associated Table 1. Table 1 provides the basis for the PRG, the exposure scale over which the PRG will be applied and a series of notes related to the various PRGs.
57	Portland Harbor RALs	2.1.3	2-3		General	RAOs, RGs and RALs	The EE/CA states, "However, the RAL for 2,3,4,7,8-PCDF is equal to its PRG. The draft Portland Harbor FS report uses 'sum' instead of 'total.' These terms are equivalent and, therefore, cleanup of areas with 2,3,4,7,8-PCDF RAL exceedances will result in a SWAC (surface-weighted average concentration) that is far below the PRG. For example, based on figures provided in Appendix Da of the draft FS report, a RAL of 1.75 µg/kg (1,750 pg/g) should yield a SWAC equal to the PRG of 0.02 µg/kg (20 pg/g) for RM 7–8 (FS Appendix G). Consequently, a RAL for 2,3,4, 7,8-PCDF in the range of 1–2 µg/kg (1,000–2,000 pg/g) for RM 6.5–7.5 would be consistent with a 10^{-4} risk management goal based on exposure via consumption of smallmouth bass and will be evaluated in this EE/CA. EPA directed the LWG (Lower Willamette Group) to use RALs of 10 and 20 pg/g, which are at or below the corresponding PRG, which is clearly an error as RALs should be greater than the respective PRG." This text is problematic for several reasons. First, the referenced figures appear to be in Appendix Db, not Appendix Da, of the draft FS. Second, the conclusion that the RAL for 2,3,4,7,8-PCDF is equal to its PRG appears to be unfounded. While the EPA-directed RG is 0.0205 ppb (associated with a 10^{-4} human health adult smallmouth bass risk scenario), EPA also directed that the LWG evaluate effectiveness against other, lower values that were included in the list of PRGs. Third, Tables 1-1 and 1-3 in Appendix Fa of the draft FS present a range of PRGs for 2,3,4,7,8-PCDF. The 14 PRGs in Table 1-1 are applied on a site-wide basis and range from 0.000538 ppb to 0.00946 ppb. The estimated pre-remedy site-wide SWAC for 2,3,4,7,8-PCDF is 0.0114 ppb, higher than all of the PRGs. The 10 PRGs in Table 1-3 of Appendix Fa are applied on a 1-river mile basis and range from 0.00619 ppb to 0.06980 ppb. The estimated pre-remedy SWAC for RM 6.5-7.5 for 2,3,4,7,8-PCDF is 0.108 ppb, much higher than all of the PRGs. In the draft Arkema EE/CA, LSS estimated a SWAC of 0.06 ppb for 2,3,4,7,8-PCDF under all of the alternatives evaluated (see Table 7-2). This SWAC would exceed all but one of the 10 PRGs presented in Appendix Fa, Table 1-3, of the draft FS. The above issues should be addressed as part of the 5-step process identified in **Comment #52**, which will appropriately consider all available PRGs. Note again, that PRGs and RGs are being revised for the harbor-wide process and final values may render much or all of this comment moot. Revised PRGs and RGs will have to be used in the final EE/CA.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
58	Portland Harbor RALs	2.1.3	2-4		Specific	RAOs, RGs and RALs	The paragraph in bold beginning with "**Based on the results of the BHHRA, potential cancer risks via consumption of large home range fish…"** should be deleted. Not only is this statement inappropriate risk management, it is not even directed at the Arkema site and makes incorrect assumptions that the current draft FS, which is currently under review, can be used to inform the EE/CA, that 10^{-4} is a bright line decision point -- contrary to EPA guidance, and that constituents of DDx can be assessed independently. The paragraph is incorrect and adds nothing to the EE/CA process. EPA is currently recalculating PRGs and RGs based on consumption of fish as part of the harbor-wide process. These values will need to be used in the Arkema EE/CA. Thus much of the discussion in the EE/CA regarding PRGs and RGs will need to be revised once final values are developed.
59	PCDD/Fs	2.2.2			General	RAOs, RGs and RALs	Background: Discussions of background appear to center on possible non-Arkema sources of dioxins/furans rather than on use of background to evaluate the vertical boundary of the RAA. Background helps to establish a lower limit for sediment concentrations. Estimates for harbor-wide background should be used as a starting point for evaluating the possible upper limit of sediment remediation in the EE/CA.
60	Distribution of PCDD/Fs	2.2.2.3	2-12		Specific	RAOs, RGs and RALs	The RAL is listed here as 1,725 pg/g, whereas it is listed as 1,750 pg/g in Section 2.2.2.1.
61	Other EPA-Directed COIs	2.2.3			General	RAOs, RGs and RALs	Although not intentionally manufactured, hexachlorobenzene is a by-product of the production of chlorine (and possibly chlorate) where graphite anodes were used (Mumma et al, 1975[1]). It is produced by the reaction of chlorine with the graphite anode materials such as carbon and oils. The text is contrary to this conceptual site model by stating "there is no evidence or history of spills of any of the EPA-directed COIs on the Arkema site, so inclusion of the COIs is wholly unsupported". This incorrect conclusion has led to their exclusion in the Data Screening Results Tables (Table 2-2, indicated as "not applicable") and the selection of RAOs (Section 3.1.2.3) and RGs. The screening tables must be revised. Further, the source of any of the COIs is not material. If they occur in sufficient quantity within the RAA, they will have to be considered in establishing the vertical boundaries. The action within the RAA is to be final. Finally, hexachlorobenzene might be a good marker for the presence of dioxins and furans since the formation of both co-occurred in the graphite cells and both may be co-located in waste streams and disposal on site. Harbor wide concentrations of hexachlorobenzene are focused on the Arkema site. 1) Mumma, C.F.; Lawless, E.W. 1975. Survey of Industrial Processing Data. Task I – Hexachlorobenzene and Hexachlorobutadiene Pollution for Chlorocarbon Processes (EPA 56013-75-004), Washington D.C.
62	Revised Arkema Removal Action RAOs	3.1.2.3	3-4		Specific	RAOs, RGs and RALs	The Portland Harbor FS groundwater RAOs for protection of human health (RAO 4) and ecological receptors (RAO 8) have been eliminated from consideration in the EE/CA. These RAOs should be incorporated into the removal action RAOs to address upland source control requirements and ensure consistency with the harbor wide process.
63	Revised Arkema Removal Action RAOs	3.1.2.3	3-4		Specific	RAOs, RGs and RALs	RAO 4b eliminates the surface water component. This should be retained for consistency with the Portland Harbor FS and harbor wide process.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
64	Other Objectives	3.1.3	3-6		Specific	RAOs, RGs and RALs	The Portland Harbor management goals are presented in this section. Management goals 1 and 2 are particularly relevant to the Arkema Removal Action due to integration of the NTCRA with upland source control measures to address stormwater and groundwater pathways and because both management goal 2 and 3 are similar in concept to proposed removal action objective 7. Management goal 2 is an important goal with respect to protecting fisheries in the Columbia River and should be explicitly considered in the EE/CA for the Arkema site. The EE/CA should discuss the relationship of the removal action objectives with the management goals in more detail specifically focusing on how achieving the removal action objectives will contribute to achievement of the management goals established for the Portland Harbor site.
65	Identification and Analysis of Removal Action Alternatives	7	7-2		Specific	RAOs, RGs and RALs	Section 7 describes the removal action alternatives developed in the EE/CA. There are references to the DDT and DDE RALs, which presumably are the 6 mg/kg (DDT) and 0.4 mg/kg (DDE) values mentioned in Section 2. This should be made explicit for clarity.
66	Post-Removal Action Recontamination Assessment	4			General	Recontamination Evaluation	It appears that the EE/CA assumes that upland hydraulic control will create zero to negative flux through subsurface contaminated sediment over the majority of the site. It is not appropriate to rely on interim upland source control measures to address subsurface contaminated sediment, and such groundwater flux conclusions may not be warranted. Consequently, the EE/CA should be revised to consider a range of flux measurements. That said, an active cap could be an effective approach to manage flux of contaminated groundwater to the river (contaminated from subsurface river sediment or otherwise).
67	Post-Removal Action Recontamination Assessment	4			General	Recontamination Evaluation	EPA has previously noted concerns with the use of the model SEDCAM during review of the stormwater SCM design. SEDCAM is a screening level modeling tool that is applied for the recontamination analysis. SEDCAM is a simple steady-state model which is being used to estimate COI concentrations in an assumed layer of surface sediments over a 50-year period. A "steady state" model considers a single set of environmental conditions which are assumed to be constant for the entire period (e.g., sedimentation rates, storm water runoff, upstream river water quality, runoff water quality). These highly dynamic processes are all assumed to be constant for the 50-year period of analysis. This simplified modeling approach can provide a screening level line of evidence but is typically not adequate to conduct a comparative analysis of alternatives for an EE/CA. EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. EPA will provide guidance on the recontamination evaluation framework to LSS.
68	Post-Removal Action Recontamination Assessment	4			General	Recontamination Evaluation	Section 4 describes the LSS assessment of the potential for recontamination of sediments after a removal action is conducted. There does not seem to be any discussion or analysis of the potential for deeper sediments to contaminate shallow sediments (in the event of a partial removal) if the removal action is limited to the top three feet, for example, as it is in Alternatives 2(i) and 2(r). Locally-caused recontamination could occur by diffusion, bioturbation, prop scour, or future development activities, such as an expanded navigation channel to accommodate larger vessels. A discussion of the potential for subsurface sediment to contaminate shallow sediments should be added to this section.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
69	Post-Removal Action Recontamination Assessment	4			General	Recontamination Evaluation	Recontamination Assessment (Section 4 and Appendix H) – The recontamination assessment makes sweeping conclusions about upstream loads and potential site-based loads that are not supported by inclusion of data, rationale, calculations, model runs, and sensitivity analysis. For instance, it is unclear how general information on water column impairment of Johnson Creek relates to sediment quality, volume of sediment contribution to the Willamette River, or sediment load in the river over more than ten river miles to the Arkema project site. This is troubling because sediment sampling data from 0.01 river mile upstream of the site is averaged and presented as the upstream concentration of DDx, while sediment data from RM 7.8 to RM 16 (in particular the extensive data available from the Downtown Reach at RM 12-16 and new sediment conditions following extensive capping at Zidell at RM 11) are not considered, but unqualified information on the sediment contaminant contribution from a tributary entering the Willamette River at RM 18.9 is somehow considered. Although low levels of DDT and related chemicals have been detected in background surface water samples collected from the Willamette River, these values are generally below state water quality standards and the Willamette River is not currently classified as water quality limited for DDT and related chemicals. Given the complexity of the river setting and potential pathways for recontamination, it is likely that more detailed analysis (potentially including hydrodynamic and sediment transport modeling) should be prepared to refine input parameters, better quantify uncertainty, and account for hydrodynamic variability. EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. EPA will provide guidance on the recontamination evaluation framework to LSS.
70	Groundwater Appendix F - Riverbank Alternatives Evaluation	4.2.1	4-2 7		Specific	Recontamination Evaluation	The EE/CA does not provide any technical analysis to support the conclusion that any COCs potentially leaching from soil to groundwater on the riverward side of the groundwater barrier wall (GWBW) will flow towards the barrier wall away from the river thus containing any highly mobile hot spots. This conclusion is further inconsistent with design of the low permeability (1×10^{-6} cm/sec) soil-bentonite slurry wall which is considered a no flow groundwater boundary. The text should provide the technical information/evaluation that supports the conclusion that COCs will flow towards the barrier wall on the riverward side of the barrier wall. See similar issue in Appendix F, Consideration of Hot Spots, second paragraph.
71	Stormwater	4.2.2	4-2		Specific	Recontamination Evaluation	The section concludes that "*The potential for recontamination of future remediated sediments following completion of the treatment system was evaluated and indicated minimal recontamination (Integral 2011).*" This conclusion is based on SEDCAM steady state modeling results and use of a constant upland stormwater treatment effluent concentration of 0.05 ug/L for each DDx analyte. The analytical approach using SEDCAM is inadequate per **Comment #67** above. The ability of the stormwater treatment system to consistently achieve effluent concentrations has not been adequately demonstrated. EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. EPA will provide guidance on the recontamination evaluation framework to LSS.
72	In-waterway Sediment Transport and Deposition	4.2.5	4-3		Specific	Recontamination Evaluation	The EE/CA states that "Where [SEDCAM model] parameters were uncertain, a range of values were evaluated to provide a bounding estimate of potential sediment concentrations." The EE/CA should provide a basis for the uncertainty and the range of values evaluated should be commensurate with the level of uncertainty.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
73	Evaluation of Alternative 2(r)	7.2.3.11	7-15		Specific	Recontamination Evaluation	Alternatives 2(i), 2(r), 3(i), and 3(r) include dredging and placement of an engineered cap. The removal of contaminated sediments to support the placement of an engineered cap is potentially effective. However, two issues are a concern; 1) LSS agreed during informal dispute resolution that capping would not be evaluated as the primary remedial approach as it is for Alternatives 2(i) and 2(r) (see **Comment #101**); and 2) the level of contamination left behind must be low enough not to result in recontamination of the cap surface due to migration from below. If not, the cap must include reactive amendments such as organoclay that can prevent migration through the cap and the in-water remedy must be coupled with upland source efforts sufficient to prevent recontamination from below. Alternatives 2(i) and 2(r) should be modified such that capping is not the primary remedial approach and the text for Alternatives 3(i) and 3(r) should be revised to address the recontamination concern.
74	Appendix H - Recontamination Assessment				General	Recontamination Evaluation	The SEDCAM recontamination analysis is based on average conditions (hydrology, meteorology for a 50 year period). While it is not uncommon to apply steady-state modeling tools for permitting or other regulatory processes; they are typically applied to "critical" or "design" conditions (i.e., worst-case or near worst-case). The proposed recontamination analysis does apply "conservative" assumptions and presents a sensitivity analysis but it does not go far enough in developing a useful consistent approach that could be applied as a screening level line-of-evidence to predict recontamination potential for developing remedial alternatives. EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. Further guidance on conducting recontamination evaluations will be provided by EPA (see **Comment #67**).
75	Appendix H - Recontamination Assessment		3		Specific	Recontamination Evaluation	The recontamination evaluation analysis is simply based on the assumed treatment of stormwater loads sufficient to meet an effluent concentration of 0.05 micrograms per liter (µg/L) for each DDx analyte. Performance monitoring data must be provided to substantiate these concentrations. The modeling analysis is inadequate because recontamination evaluation should consider uncertainty in the stormwater concentrations from the upland areas. Modeling should consider "worst case" conditions (e.g., extreme storm events resulting in upset/bypass of the stormwater treatment system). The SEDCAM model analysis should include a range of stormwater effluent concentrations, including "worst case" conditions. EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. Further guidance on conducting recontamination evaluations will be provided by EPA (see **Comment #67**).
76	Appendix H - Recontamination Assessment		5		Specific	Recontamination Evaluation	The document states, "*With the exception of DDE at the existing upstream sediment concentrations and a low net sedimentation rate, all modeled conditions meet the Portland Harbor's most conservative RAL, which corresponds with Portland Harbor remedial Alternative F.*" The Portland Harbor Draft FS RALs should be included in Table 2 and the magnitude of the DDE exceedance should be documented.
77	Appendix H - Recontamination Assessment		6	Table 2	Specific	Recontamination Evaluation	Table 2 should be labeled to be consistent with Figure 1. The column headings should indicate Scenarios 1, 2, and 3 and the "low" Net Sedimentation Rate should indicate "1 cm/yr" vs. the high sedimentation rates of "5 cm/yr."

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
78	Appendix H - Recontamination Assessment		6		Specific	Recontamination Evaluation	The document concludes that: "*Model results for all analytes indicate some recontamination following remediation from upstream loads*" and "*The model results suggest that the extent of the recontamination and the achievement of the remedial goals will depend on the upstream sediment COI concentrations, ongoing net sedimentation rate in the RAA, and the implementation of upstream SCMs*." These conclusions regarding the influence of upstream loads and implementation of upstream SCMs are not supported by the modeling results. Table 2 and Figure 1 clearly show that the model is sensitive to changes in the sedimentation rate (Rs). However, a 50% reduction in upstream loads (e.g., Scenario 2 vs. 3) only results in a minor reduction in sediment concentration. Moreover, by maintaining the upland stormwater concentrations constant at 0.05 µg/L, the analysis does not provide any useful assessment of the influence of upland stormwater contributions on sediment recontamination. At a minimum, the SEDCAM modeling analysis should be revised to address these issues. However, EPA is working with DEQ to develop a framework for more robust recontamination evaluation analytical approaches. Further guidance on conducting recontamination evaluations will be provided by EPA (see **Comment #67**).
79	Identification and Protection of Cultural Resources	5	5-1		General	Remedial Design	EPA recommends that LSS consider developing an Inadvertent Discovery Plan for Alternatives 2(i) through 5 that would be followed should cultural material be encountered.
80	Removal Action Area Characterization	2			General	Risk Evaluation	Discussions in the EE/CA do not appear to fully recognize the importance of spatial patterns. For purposes of the EE/CA, estimates for RAL and risk reduction should be based on a mile of the west river bank starting just upstream of the salt dock and continuing downstream toward the railroad bridge. The navigation channel should not be included, nor should any of the east bank within this river segment.
81	Nature and Extent of Contamination and Streamlined Risk Evaluation	2.2	2-6		Specific	Risk Evaluation	The risk evaluation does not present the result of the revised Baseline Human Health risk assessment (see September 17, 2012 draft and Dispute Decision, December 6, 2012. There must be acknowledgement that the concentrations of site contaminants present a significant risk to human health and the environment.
82	Data Screening Summary	2.2.1.2	2-8		Specific	Risk Evaluation	The EE/CA should acknowledge that all surface sediments within the RAA exceed the 0.218 DDx PRG and that the majority of the area exceeds the 5 mg/kg RAA criteria. There needs to be an explicit statement that risk based levels are exceeded throughout the RAA and that risks to human health exist on a RM basis offshore of the Arkema site based on the fish consumption pathway and that remediation of the area within the RAA will reduce overall risks to human health and the environment in the vicinity of the Arkema site for a range of receptors and exposure areas. (Note again that PRGs for DDx and other COI are in the process of revision. Revised PRGs and RGs should be used in the final version of the EE/CA.)

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
83	Other EPA-Directed COIs	2.2.3	2-14 through 2-17		Specific	Risk Evaluation	The draft EE/CA evaluated a range of other chemicals including chlordane, lindane, hexachlorobenzene, total PCBs and tributyltin (TBT). The EE/CA does not present a clear train of logic for eliminating these chemicals for consideration of areas requiring active remediation or in evaluation of the alternatives. A more robust evaluation, as described in **Comment #52**, is needed in the EE/CA to support LSS' use of DDT and DDE as the "primary basis for defining the vertical boundary of the RAA and in evaluating the lateral and vertical extent of various removal action technologies (e.g., dredging, capping, monitored natural recovery [MNR]) when assembling remedial alternatives." (EE/CA, page 3-12).
84	Appendix F - Riverbank Alternatives Evaluation		5		General	Risk Evaluation	Conclusions from the Source Control Screening and Weight-of-Evidence Evaluation: There is a significant discrepancy between the conclusions presented in the LSS riverbank source control screening and the DEQ and EPA review comments dated 21 July 2009. This section must address and incorporate to the extent relevant all of the DEQ/EPA review comments and conclusions.
85	Arkema Site Operational History	1.2.2			General	Site Characterization	This section should provide a more detailed discussion of the various processes that occurred on-site which includes the chemicals used, their by-products and associated wastes management. For example, chlorine manufacturing has been known to produce chloroform, carbon tetrachloride, hexachloroethane, pentachloroethane, trichloroethane, tetrachloroethylene, dichloroethylene and 1,1,2,2-tetrachloroethane as by-products. In addition, hexachlorobenzene has been found to be a by-product of the use of graphite anodes and hexachlorobutadiene has been associated with chlorine gas liquification.
86	Nature and Extent of COIs in Groundwater	1.3	1-9		Specific	Site Characterization	This section provided fairly limited data on COIs in groundwater. A complete list should be provided.
87	Removal Action Area Characterization	2	2-22		Specific	Site Characterization	EPA recommends that a site characterization summary section be added to support the discussion presented in Section 3 and later evaluation of alternatives.
88	Data Screening Summary	2.2.1.2	2-8		Specific	Site Characterization	Additional detail is needed to support the data used in the screening risk evaluation. First, the term "adjacent to the site" should be defined (e.g., data from RM 6 to 7). Also, please see comment on relevant risk evaluation river mile data review. Data should be taken from the area of concern for EE/CA evaluation, which includes west bank sediments between OHW and the navigation channel starting at approximately RM 7.5 and continuing downstream to RM 6.5. Second, some discussion is needed to describe available data in terms of density of sampling both horizontally and vertically. This discussion should recognize relative lack of data for sediments below 30 cm and should determine how this data gap affects subsequent EE/CA analyses. Finally, the discussion should identify two separate data sets -- one for screening of data within the RAA and a second for RAL calculations. The first data set will be subset of the second.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
89	Distribution of DDx	2.2.1.3	2-9		Specific	Site Characterization	The EE/CA states, "This cross section clearly shows that the detected DDx sediment areas downstream of Dock 2 have a limited vertical extent and are not contiguous. Note that as a result of the sample spacing downstream of Dock 2, there is higher variability in the EVS model in this area and, therefore, there is some uncertainty as to whether these discrete 'islands' downstream of Dock 2 are laterally discontinuous." These two statements are inconsistent. The "discontinuous" islands downstream of Dock 2 are not delineated by lower concentration data points and are therefore not "clearly" discontinuous. This is an area of uncertainty and the text should be revised to describe it as such in accordance with the Opalski Decision. The 2011 Opalski Decision states that, "LSS is not required to adjust its contouring to represent the three "islands" as a contiguous area within a single 5 ppm DDx contour. However, LSS shall note in the final text that the variability of the model increases for the area of the downstream "islands", suggesting some uncertainty as to whether the data could be representing a contiguous area rather than the three discrete islands depicted in Figure 4-2."
90	Distribution of DDx	2.2.1.3	2-9		Specific	Site Characterization	Cumulative distribution plots of screening data (e.g., box and whisker plots) should be developed and presented on plots that also show relevant PRGs. Such figures will provide instant visualization of how PRGs are related to data distribution, and, when evaluated along with site figures depicting exceedance of RALs, provide an understanding of mass of different COIs that will be addressed by any of the alternatives included in the EE/CA.
91	Distribution of DDx	2.2.1.3	2-10		Specific	Site Characterization	Footnote 19 should be deleted as referring to rejected EPA split data that supports "smaller island" footprints in the EVS model adds no value to the discussion.
92	PCDD/F Sources	2.2.2.4	2-12		General	Site Characterization	The dioxin source evaluation results suggest that there may be other dioxin sources present off shore of the Arkema site. However, the risks are dominated by the PeCDF homolog group, including the 2,3,4,7,8-PeCDF congener, which are known to be associated with chloralkali production at the Arkema site. This section should discuss Arkema sources of dioxin/furans and put possible associated risks in perspective.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
93	PCDD/F Sources	2.2.2.4	2-12		General	Site Characterization	The primary environmental concern associated with the Arkema site is the accumulation of persistent bioaccumulative toxic substances (PBTs) in Willamette River sediment adjacent to the site. These PBTs include DDx, dioxins/furans, hexachlorobenzene, and chlordane. The focus of the upland remedial investigation and in-water EE/CA has been the PBT DDx (DDT and isomers). Because the site contaminant release model was not updated by LSS until after the Parametrix 2007 EE/CA work plan, the focus of the EE/CA work continued to be on DDx with limited dioxin/furan, hexachlorobenzene, and chlordane sediment data collected. However, the accumulation of the other PBTs at the site is equally a concern, particularly dioxins/furans. While the presence of dioxins/furans are acknowledged and discussed in the draft EE/CA, beyond allocation arguments their distribution are not synced with the site operational history and potential Arkema related dioxin/furan sources (e.g., riverbank fill debris and chlorine/chlorate production wastewater discharge). Further, the draft EE/CA inappropriately limits the distribution of dioxins/furans in sediments related to site operations (predominately Area 1) which is not supported by site data and then builds EE/CA alternatives around this unsupported data interpretation (e.g., detection of 2,3,4,7,8-PCDF above the RAL is limited to samples collected within Area 1). The first paragraph of Section 2.2.2.4 states: "Samples of upland soil and groundwater, and sediment immediately offshore in the Willamette River, were analyzed for dioxins/furans, and a homologue pattern consisting primarily of PCDF homologues was consistently found in areas where onsite sources of PCDFs were suspected... LSS believes that certain chlorinated furans may be incidental by-products of historic chlor-alkali production technology involving the use of Gibbs cells at the site. The source of such compounds is believed to be the chlorination of precursor furans associated with coal tar used on Gibbs cell tops." Because the discharge to the Willamette River of waste waters potentially containing dioxins/furans would have occurred for years/decades longer than the discharge of DDT-related manufacturing wastes, it is expected that the accumulation of site-related dioxins/furans will occur shallower in river sediment than DDx and have a larger sediment footprint. The EE/CA divides the RAA into two areas Area 1 and Area 2. Data from Area 1 (EE/CA Figure 2-2) shows the distribution of total PCDD/F congeners predominantly in Area 1 and elevated levels extending to surface sediments. The presence of site-related dioxins/furans in shallower sediments above the accumulation of DDT is consistent with the updated contaminant release model. However, the EE/CA does not acknowledge this as it instead suggests that the shallow distribution is an artifact of larger sampling intervals (Page 2-11, last paragraph). Figure 2-2 also inappropriately indicates that the lower concentrations of dioxins/furans downstream of the #2 Dock leading to the EE/CA conclusion that Area 2 is a strong candidate for MNR and ENR. Figure 3-3 [Core Plots of Total PCDD/F Sediment Data (2009 EE/CA boreholes)] from the 2011 Integral Final Removal Action Characterization Report illustrates the sparcity of dioxin furan sediment data downstream of the #2 Dock from mud line to depths of 6 to 10 feet. Consequently, there is no bounding dioxin/furan sediment data to base the boundary shown on Figure 2-2 of the EE/CA or to support the EE/CA statements regarding the low levels of dioxin/furans in Area 2. The data indicates that the elevated levels of dioxins/furans observed in Area 1 extend downstream into Area 2. The discussion of sources of PCDD/F is superficial and gives the impression that the authors were seeking to justify a specific end. This entire subsection should be stricken and replaced with a rigorous evaluation of PCDD/F sources. Alternatively, the EE/CA can proceed without this analysis and the subsection can simply be removed.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
94	PCDD/F Sources	2.2.2.4	2-13		Specific	Site Characterization	The list of potential sources presented at the bottom of Page 2-13 includes sites that are unlikely sources of dioxin based on the results of the upland remedial investigations underway. For example, no data is available to suggest that Siltronic, Willbridge, and Gould/NL (excepting the contribution from the Rhone Poulenc site) are sources of dioxin to the Willamette River. Unless justification can be provided, Siltronic, Willbridge, and Gould/NL should be removed from this list.
95	Other EPA-Directed COIs	2.2.3	2-14		Specific	Site Characterization	The discussion of other COIs lacks consideration of the large amount of LWG data and analysis available. Specifically, sediments off-shore of the Arkema property are notable hot spots for total chlordanes and PCBs in surface sediments (see LWG ARCView application). These chemicals were included as COIs in part because of high concentrations in these sediments relative to other segments of the Willamette River. Moreover, upstream sources of these chemicals are not obvious and the distribution of these COIs does not suggest significant historical or ongoing sources, at least for surface (0 to 30 cm) sediments. Thus, for these COIs it is critical to examine residual contamination for each of the EE/CA alternatives to help ensure that the vertical extent of removal/remediation is appropriately defined. The issue could be particularly important for PCBs, since data from many samples are heavily influenced by high detection limits. Within a dredge prism defined using data on other COIs, this observation is not important, but on the edges of the prism and downstream, PCB data are needed to help ensure that the EE/CA effort is "one and done", at least within the area and volume of sediment subject to active remediation (e.g., capping, removal, or containment in a CDF). The harbor-wide distribution of COIs can also be used to help with the evaluation of tributyltin and lindane. In surface sediments, none of these COIs report notably higher concentrations offshore of the Arkema site, and a substantial source for tributyltin and lindane is apparent at Swan Island. Although these distributions only reflect surface sediment, they nonetheless support the contention that these three COIs are not likely to be important for risk reduction, and therefore, for defining the vertical extent of the RAA. A more complete analysis of other COIs should be added to Section 2.2.3 as appropriate.
96	Other EPA-Directed COIs	2.2.3	2-14		Specific	Site Characterization	The statement, “However, there is no evidence or history of spills of any of the EPA-directed COIs on the Arkema site, so inclusion of these COIs is wholly unsupported” should be deleted because it is irrelevant. These COIs are present in the Early Action area and need to be addressed by the action in accordance with the 2011 Opalski Decision, which stated, "All COIs shall be considered in developing and evaluating removal alternatives." The purpose of considering all COIs is also stated in the 2011 Opalski Decision: "EPA consistently has framed this removal action in terms of minimizing the extent to which the action taken within the removal action area will need to be revisited as part of a final remedial action. Besides the various pragmatic arguments for this framing, it is consistent with the requirement of the National Contingency Plan that removal actions shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action." All similar statements in the subsections of Section 2.2.3 should also be deleted. These COIs should be evaluated using the 5-step process discussed in **Comment #52** to determine if they are COCs for the Arkema site and this evaluation should be provided in the EE/CA.
97	Total Chlordanes	2.2.3.1	2-14		Specific	Site Characterization	The LWG ARCView application depicts an area of elevated concentrations for total chlordanes in sediments offshore of the Arkema site, without any indication of a significant upstream source. These data need to be considered in the evaluation of chordanes. Further, the conclusion "there is no evidence of a source of total chlordanes at the Arkema site ..." should be removed. Historical records are not sufficient to support such a definitive statement, and just the observation of elevated concentrations at Arkema in surface sediments is "evidence of a source."

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
98	Total PCBs	2.2.3.4	2-16		Specific	Site Characterization	The discussion of total PCBs data lacks rigor and should be revised to address the following issues. A large number of samples report non-detect (ND) with elevated detection limits, making definitive statements about the distribution of PCB as "sporadic and consistent with urban background" difficult to accept. The LWG ARCView application shows an area of elevation concentrations for PCB in sediments off-shore of Arkema with no obvious upstream source. The EE/CA needs to address "one and done" at least for the portions of the site where capping, active removal, and/or containment is implemented. EPA notes that the chloralkali process involves use of large amounts of electricity, and leaks and spills must at least be considered. Historical records are notoriously incomplete, and the conclusion that "there are no PCB sources from Arkema site to the river" is tenuously supported at best and should be deleted.
99	Asbestos	2.3.3.2	2-21		Specific	Site Characterization	EPA agrees that additional asbestos data will be needed during the remedial design process to address the uncertainties in the few data available. EPA also agrees that this is an issue of waste handling and disposal only.
100	Description and Applicability	6.3.1	6-6 to 6-7		General	Technology Evaluation - Assignments	An objective and thorough analysis should be provided in the EE/CA for the full removal of all contaminated material for a complete comparative analysis of alternatives. The analysis should analyze implementability (i.e., practical limits of dredging with rationale detailed) and costs, but not just be screened out.
101	Identification and Analysis of Removal Action Alternatives	7			General	Technology Evaluation - Assignments	LSS agreed during informal dispute resolution that, "it will not evaluate capping as a primary remedial approach. The evaluation will be limited to localized, isolated areas that may or may not have been dredged."[1] However, Alternative 2(i) and Alternative 2(r) both rely on capping as the primary active remedial approach, and Alternative 2(i) was selected as the preferred remedial alternative. Alternatives 2i and 2r should be removed or modified in the next draft of the EE/CA such that capping is not the primary remedial approach. 1) EPA. 2009. Letter from Sean Sheldrake to LSS re: Resolution of Disputed Issues Pertaining to the EE/CA Work Plan Addendum and Evaluation of a CDF in the EE/CA. See Attachment - January 29, 2009 E-mail from Steve Parkinson to Lori Cora. U.S. EPA Region 10. February 21, 2009.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
102	Institutional Controls	7.2.2.8			General	Technology Evaluation - Assignments	While the EE/CA provides the objectives of institutional controls to be implemented for the various alternatives (all alternatives reference the Alternative 2(i) institutional control section), the types and nature of the institutional controls that might be implemented are not discussed. It is not compliant with the NCP or EPA guidance to leave any analysis of the types of ICs that are available for use to remedial design (see guidance documents referenced below). The general types and nature of institutional controls contemplated need to be assessed for implementability and long-term reliability as part of the response selection process and must be discussed. 1) Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites, December 2012 [PDF 452K / 40pp.] 2) Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups, EPA 540-F-00-005, OSWER 9355.0-74FS-P, September 2000 [PDF 221K / 32pp.] 3) http://www.epa.gov/superfund/policy/ic/guide/index.htm
103	Containment	6.4	6-14		Specific	Technology Evaluation - Capping	The draft EE/CA should include more discussion of the use of reactive capping technologies. Material such as organoclay can be incorporated into a cap design for the purpose of containing potentially mobile NAPL. Although the draft EE/CA assumes that the cap will be composed of a sand layer with 2.5% granular activated carbon (GAC) by weight, the use of other reactive materials such as organoclay should be given greater consideration in the draft EE/CA.
104	Containment	6.4	6-15		General	Technology Evaluation - Capping	The EE/CA states: *The potential for reductions in contaminant concentrations following implementation of the barrier wall and the observed variation in the available data warrant careful re-consideration in determining the design characteristics and extent of a cap required to achieve the remedial goals.* The containment section needs to discuss scour issues caused by marketing of the property to river dependent uses (i.e., businesses who will use the current or a replacement dock structure). The discussion also needs to include flood rise and flood storage evaluation implications, and present a feasibility-level evaluation of both that satisfies an EE/CA-level of analysis.
105	Sediment Capping	7.2.2.3	7-8		Specific	Technology Evaluation - Capping	The EE/CA states: *Although contaminant mobility (e.g., due to upwelling or diffusion) is expected to be insignificant due to the implementation of groundwater SCMs in 2012-3 and the immobility of the majority of the COIs, the cap may be amended in localized areas with GAC or similar active materials if remedial design analysis determines that such provisions are necessary.* LSS should add a statement that, "Performance would be verified post implementation through measures such as use of piezometers and passive samplers."

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
106					General	Technology Evaluation - Dredging	Given the high levels of PBTs in river sediment at the site, there is concern about impacts/risks from sediment resuspension, release of PBTs, and residual concentrations to the environment and the food web, both during and after remedial measures that involve dredging. A more thorough analysis is needed in the EE/CA that considers cost, implementability, and effectiveness of containment relative to short-term effectiveness of dredging. The EE/CA does not acknowledge or attempt to quantify the magnitude and duration of impacts to the food web which may result from the various remedial alternatives. In accord with the recommendations in the US Army Corps of Engineers Dredging Operations and Environmental Research Program document, *The Four R's of Environmental Dredging: Resuspension, Release, Residual, and Risk* (ERDC/ELTR-08-94), the analysis should consider changes in risk that would result from potential impacts from resuspension, release and residuals resulting from dredging, over both the short-term and long-term, for comparative assessment of each remedial alternative. Predictions of potential dredging risk can be modeled using input from field and laboratory investigations. Needed input includes: measured rates of site contaminant adsorption, absorption, and desorption in order to model non-equilibrium partitioning to both site water column solids and sediment; measurement of flocculation rates, sizes and densities and settling rates for a prediction of how these will change in the field as fluid shear and sediment concentrations change; sediment-water flux studies both with and without benthic organisms; dredging elutriate testing for both during dredging and release back to the river of any stored water associated with dredging. A more thorough evaluation needs to be prepared to demonstrate that containment is unnecessary, or to determine if containment is needed. Unless the concerns raised above are adequately addressed, only a rigid containment option, such as a coffer dam, would be acceptable in areas where dredging will occur because it has not been adequately demonstrated that the risks are acceptable without containment.
107	Identification and Evaluation of Removal Action Technologies	6	6-13		General	Technology Evaluation - Dredging	The EE/CA concludes, page 6-13, that engineering controls to support dredging such as rigid containment or coffer dams are not technically practicable due to the shallowness of bedrock at the site. It also questions the effectiveness of silt curtains and identifies a number of implementation concerns with their use at the site. EPA does not concur that rigid containment is not implementable. EPA acknowledges that there are design challenges for rigid containment using sheet piles in the thin sediments to the channel-side of the Arkema docks. The EE/CA indicates that king piles and other designs are not technically feasible. EPA requests further technical backup to support this contention. Further, although the EE/CA states that "short-term risks to the environment during implementation would be limited through engineering controls, BMPs, and other measures to ensure compliance with ARARs," LSS has not adequately described with sufficient detail what the engineering controls referenced entail.

No.	Section	Section Number	Page	Figure or Table Number	Comment Type (General or Specific)	Comment Subject	Comment
108	Barrier Controls	6.3.4.2	6-12		Specific	Technology Evaluation - Dredging	The draft EE/CA underestimates the effectiveness of sheet pile containment and over emphasizes operational issues associated with sheet piles. The draft EE/CA asserts that containment measures such as sheet pile walls are unsuccessful because a small amount of contamination still escapes when such methods are utilized. However, sheet pile containment is being used successfully at the Diamond Alkali Removal action on the Passaic River in Newark, New Jersey. The use of skirts to prevent erosion and sealants to prevent loss of material are two examples of how sheet pile effectiveness can be improved. Further, EPA does not agree with the position that barriers to control suspended sediment during dredging are not warranted. The EE/CA states such controls are not necessary, yet then uses such increased short-term risk during excavation as negative aspects of Alternatives 3-5 which include more dredging. LSS needs to provide more technical support for the contention that barrier controls are ineffective and infeasible at this site, as well as adequately establish that containment is not necessary (i.e., short term risks reductions would be minimal using containment). The dredging evaluation suggested in **Comment #106** should be used to inform the evaluation of short-term risk.
109	Barrier Controls	6.3.4.2	6-13		General	Technology Evaluation - Dredging	The EE/CA states: *As part of the Gasco Early Action, Anchor (2005) reported that sheetpiles 1) would lead to penetration of contamination along the wall configuration to much deeper depths and leave stranded contamination following removal of the sheetpiles; 2) would greatly increase the construction duration and related impacts; 3) would not lead to the complete containment of nonaqueous-phase liquid and dissolved contaminant releases from the containment area; 4) would temporarily impound a large volume of water in which construction activities could create substantially concentrated contaminant loads, which could cause adverse impacts upon release when containment is removed...* The reference provided above is outdated (a pre-project reference). The correct reference would be the Parametrix After Action Report on the EPA website that details what a huge failure silt curtains were for that project. Based on the lack of information in the EE/CA and experience at other dredge sites, EPA does not concur that rigid containment is too costly, would lengthen the schedule, and therefore is not implementable as indicated in the summary provided on page 6-13. The evaluation of barrier controls should be revised accordingly.
110	Dredging	7.2.4.3	7-17			Technology Evaluation - Dredging	A more detailed discussion needs to be provided regarding the "practical maximum depth of 15 ft bml" that is used to define the maximum extent of dredging to be conducted. It is unclear if this depth is based on mass removal or technical feasibility.
111	Short-term Effectiveness	8.1.6	8-5 and 8-6		General	Technology Evaluation - Dredging	Without some form of containment during dredging, short-term (in study area) and long-term (i.e., downstream impacts) risks would likely be greater than estimated in the EE/CA. The evaluation of short-term and long-term risks needs to be re-evaluated for all alternatives (Alternative 2(i) through Alternative 5). See **Comments #106 and #108**.

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112	Appendix C - Clean Water Act 404(b)(1)				General	Technology Evaluation - Dredging	Appendix C presents a preliminary draft Clean Water Act, Section 404(b)(1) evaluation. It appears that Section 13 of Appendix C does not interpret "discharge" appropriately and should be revised. This section suggests that dredging should be avoided because there may be an associated discharge via "incidental fallback." The guidelines cited [40 C.F.R. 230.10(a)] discuss disposal of dredged or fill material to an aquatic ecosystem, not the incidental release of sediment during environmental dredging. The regulatory definition of "discharge of dredged material" at 40 C.F.R. § 232.2 includes "Any addition, including redeposit other than incidental fallback, of dredged material, including excavated material, into waters of the United States which is incidental to any activity, including mechanized landclearing, ditching, channelization, or other excavation." Although there is no regulatory definition of incidental fallback, without more supporting information, the nature of the dredging anticipated for this action will not involve incidental fallback.